

AMENDMENTS

In the Claims

Current Status of Claims

1.(canceled)

2.(canceled)

3.(canceled)

4.(canceled)

5.(canceled)

6.(canceled)

7.(canceled)

8.(canceled)

9.(canceled)

1 10.(currently amended) An analytical instrument including an excitation source for producing
2 an incident waveform, a detector for receiving either a transmission spectrum or a reflectance
3 spectrum or both a transmission spectrum and a reflectance spectrum of an object or volume of
4 interest, and a processing unit for analyzing the spectra, where the processing unit includes software
5 encoding the inverse scattering method of Claims ~~1-9~~14, 15, 16, 17, 18, 19, 20, or 21.

1 11.(currently amended) A sonic analytical instrument including a sonic excitation source for
2 producing an incident sonic waveform, a detector for receiving either a sonic transmission spectrum
3 or a sonic reflectance spectrum or both a sonic transmission spectrum and a sonic reflectance
4 spectrum of an object or volume of interest, and a processing unit for analyzing the sonic spectra,
5 where the processing unit includes software encoding the inverse scattering method of Claims ~~1-9~~14,
6 15, 16, 17, 18, 19, 20, or 21.

1 12.(currently amended) An electromagnetic analytical instrument including an electromagnetic
2 excitation source for producing an incident electromagnetic waveform, a detector for receiving
3 either an electromagnetic transmission spectrum or an electromagnetic reflectance spectrum or both
4 an electromagnetic transmission spectrum and an electromagnetic reflectance spectrum of an object
5 or volume of interest, and a processing unit for analyzing the electromagnetic spectra, where the
6 processing unit includes software encoding the inverse scattering method of claims ~~1-9~~14, 15, 16,

7 17, 18, 19, 20, or 21.

1 13.(currently amended) An analytical instrument including a sonic excitation source and an
2 electromagnetic excitation source for producing an incident sonic waveform and an incident
3 electromagnetic waveform, a detector for receiving either a sonic transmission spectrum or a sonic
4 reflectance spectrum or both a sonic transmission spectrum and a sonic reflectance spectrum of an
5 object or volume of interest, a detector for receiving either an electromagnetic transmission
6 spectrum or an electromagnetic reflectance spectrum or both an electromagnetic transmission
7 spectrum and an electromagnetic reflectance spectrum of an object or volume of interest, and a
8 processing unit for analyzing the sonic and electromagnetic spectra, where the processing unit
9 includes software encoding the inverse scattering method of Claims ~~1-9~~14, 15, 16, 17, 18, 19, 20,
10 or 21.

1 14.(new) A method for analyzing inverse scattering spectral components comprising the steps
2 of:

3 irradiating an object with a measuring wave;
4 measuring a reflection spectrum of the object;
5 measuring a transmission spectrum of the object;
6 calculating a transmission coefficient on a computer from:

7
$$t_k = 1 - \frac{ik}{2} \int_{-\infty}^{+\infty} dz e^{ikz} V(z) \psi_k^+(z),$$

8 where $V(z)$ is the location interaction between the object and $\psi_k^+(z)$ is the measuring
9 wave,
10 calculating a reflection coefficient on the computer from:

11
$$r_k = -\frac{ik}{2} \int_{-\infty}^{+\infty} e^{-ikz} V(z) \psi_k^+(z)$$

12 using a set of definitions

13
$$t_k \tilde{\psi}_k(z) = \psi_k^+(z)$$

14
$$\frac{r_k}{t_k} = \tilde{r}_k$$

15
$$\tilde{V}_1(z) = \int_{-\infty}^{+\infty} d(2k) \frac{2i}{k} \tilde{r}_k e^{-2ikz}$$

16 to convert a Lippmann-Schwinger inverse scattering equation

17
$$\psi_k^+(z) = e^{ikz} - \frac{ik}{2} \int_{-\infty}^{+\infty} dz' e^{ik|z-z'|} V(z') \psi_k^+(z')$$

18 on the computer into a Volterra-type form

19
$$\tilde{V}_1(z) = \int_{-\infty}^{+\infty} d(2k) e^{-2ikz} \frac{2i}{k} r_k \left[1 + \frac{ik}{2} \int_{-\infty}^{+\infty} e^{-ikz} V(z_j) \tilde{\psi}_k(z) \right]; \text{ and}$$

20 iterating the Volterra-type form of the Lippman-Schwinger equation on the computer to
21 produce an approximate solution $\tilde{V}_1(z)$, where $\tilde{V}_1(z)$ is absolutely and uniformly convergent.

1 15.(original) The method of claim 14, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 four terms.

1 16.(original) The method of claim 14, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 three terms.

1 17.(original) The method of claim 14, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 two terms.

18.(new) A method for analyzing inverse scattering components of a spectrum of an object of interest comprising the steps of:

obtaining a reflectance and/or transmission spectra of an object of interest using an incident waveform from the group consisting of an electromagnetic waveform, sonic waveform and mixtures or combinations thereof;

calculating a transmission coefficient on a computer from:

$$t_k = 1 - \frac{ik}{2} \int_{-\infty}^{+\infty} dz e^{ikz} V(z) \psi_k^+(z),$$

where $V(z)$ is the location interaction between the object and $\psi_k^+(z)$ is the measuring

wave,

calculating a reflection coefficient on the computer from:

$$r_k = -\frac{ik}{2} \int_{-\infty}^{+\infty} e^{-ikz} V(z) \psi_k^+(z)$$

using a set of definitions

$$t_k \tilde{\psi}_k(z) = \psi_k^+(z)$$

$$\frac{r_k}{t_k} = \tilde{r}_k$$

$$\tilde{V}_1(z) = \int_{-\infty}^{+\infty} d(2k) \frac{2i}{k} \tilde{r}_k e^{-2ikz}$$

to convert a Lippmann-Schwinger inverse scattering equation

$$\psi_k^+(z) = e^{ikz} - \frac{ik}{2} \int_{-\infty}^{+\infty} dz' e^{ik|z-z'|} V(z') \psi_k^+(z')$$

on the computer into a Volterra-type form

$$\tilde{V}_1(z) = \int_{-\infty}^{+\infty} d(2k) e^{-2ikz} \frac{2i}{k} r_k \left[1 + \frac{ik}{2} \int_{-\infty}^{+\infty} e^{-ikz} V(z_j) \tilde{\psi}_k(z) \right]; \text{ and}$$

iterating the Volterra-type form of the Lippman-Schwinger equation on the computer to produce $\tilde{V}_1(z)$, where $\tilde{V}_1(z)$ is absolutely and uniformly convergent.

1 19.(original) The method of claim 18, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 four terms.

1 20.(original) The method of claim 18, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 three terms.

1 21.(original) The method of claim 18, wherein the approximate solution includes $\tilde{V}_1(z)$ includes
2 two terms.